1. Factor the polynomial below completely, knowing that $x+5$ is a factor. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3 \leq z_4$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 15x^4 + 139x^3 + 383x^2 + 333x + 90$$

A. $z_1 \in [-5.01, -4.54]$, $z_2 \in [-3.73, -2.62]$, $z_3 \in [-1.6, 1.2]$, and $z_4 \in [-1.19, 0.12]$

B. $z_1 \in [0.37, 0.91]$, $z_2 \in [0.35, 0.89]$, $z_3 \in [2.4, 3.6]$, and $z_4 \in [3.93, 5.1]$

C. $z_1 \in [-0.16, 0.36]$, $z_2 \in [1.98, 3.21]$, $z_3 \in [2.4, 3.6]$, and $z_4 \in [3.93, 5.1]$

D. $z_1 \in [-5.01, -4.54]$, $z_2 \in [-3.73, -2.62]$, $z_3 \in [-4, -0.9]$, and $z_4 \in [-2.54, -1.2]$

E. $z_1 \in [1.45, 1.87]$, $z_2 \in [1.62, 1.94]$, $z_3 \in [2.4, 3.6]$, and $z_4 \in [3.93, 5.1]$

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2. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{6x^3 - 1x^2 - 20x + 14}{x + 2}$$

A. $a \in [6, 9]$, $b \in [-20.2, -15.3]$, $c \in [35, 40]$, and $r \in [-99, -93]$.

B. $a \in [6, 9]$, $b \in [-13.5, -8.7]$, $c \in [5, 13]$, and $r \in [-3, 4]$.

C. $a \in [-17, -11]$, $b \in [-30.2, -22.4]$, $c \in [-73, -68]$, and $r \in [-128, -122]$.

D. $a \in [6, 9]$, $b \in [9.7, 12.2]$, $c \in [0, 3]$, and $r \in [12, 22]$.

E. $a \in [-17, -11]$, $b \in [22.7, 24.5]$, $c \in [-69, -65]$, and $r \in [142, 152]$.

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3. Factor the polynomial below completely. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 8x^3 + 38x^2 + 15x - 36$$

A. $z_1 \in [-4.08, -3.9]$, $z_2 \in [-1.8, -1.23]$, and $z_3 \in [0.1, 0.9]$

B. $z_1 \in [-1.37, -1.16]$, $z_2 \in [0.22, 0.87]$, and $z_3 \in [2.3, 4.9]$

C. $z_1 \in [-0.64, -0.36]$, $z_2 \in [2.91, 3.23]$, and $z_3 \in [2.3, 4.9]$

D. $z_1 \in [-0.86, -0.55]$, $z_2 \in [1.36, 1.85]$, and $z_3 \in [2.3, 4.9]$

E. $z_1 \in [-4.08, -3.9]$, $z_2 \in [-1.2, -0.15]$, and $z_3 \in [1, 2.4]$

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4. What are the *possible Integer* roots of the polynomial below?

$$f(x) = 4x^3 + 7x^2 + 5x + 5$$

A. All combinations of: $\dfrac{\pm 1, \pm 2, \pm 4}{\pm 1, \pm 5}$

B. $\pm 1, \pm 5$

C. $\pm 1, \pm 2, \pm 4$

D. All combinations of: $\dfrac{\pm 1, \pm 5}{\pm 1, \pm 2, \pm 4}$

E. There is no formula or theorem that tells us all possible Integer roots.

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5. Factor the polynomial below completely. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 8x^3 - 22x^2 - 65x + 100$$

A. $z_1 \in [-4, -3]$, $z_2 \in [-0.96, -0.67]$, and $z_3 \in [0.1, 2.1]$

B. $z_1 \in [-4, -3]$, $z_2 \in [-0.74, -0.29]$, and $z_3 \in [4.9, 5.1]$

C. $z_1 \in [-3.5, -1.5]$, $z_2 \in [1.21, 1.28]$, and $z_3 \in [3.8, 4.2]$

D. $z_1 \in [-4, -3]$, $z_2 \in [-1.31, -1.08]$, and $z_3 \in [2.1, 3]$

E. $z_1 \in [-2.4, 2.6]$, $z_2 \in [0.79, 0.87]$, and $z_3 \in [3.8, 4.2]$

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6. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{12x^3 - 36x + 29}{x + 2}$$

A. $a \in [12, 15], b \in [-26, -18], c \in [10, 14]$, and $r \in [5, 7]$.

B. $a \in [-25, -16], b \in [-48, -47], c \in [-135, -129]$, and $r \in [-240, -232]$.

C. $a \in [-25, -16], b \in [40, 54], c \in [-135, -129]$, and $r \in [293, 294]$.

D. $a \in [12, 15], b \in [-42, -32], c \in [67, 77]$, and $r \in [-188, -182]$.

E. $a \in [12, 15], b \in [21, 29], c \in [10, 14]$, and $r \in [47, 55]$.

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7. Factor the polynomial below completely, knowing that $x - 5$ is a factor. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3 \leq z_4$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 6x^4 - 19x^3 - 81x^2 + 90x + 200$$

A. $z_1 \in [-3.1, -1.7]$, $z_2 \in [-1.43, -1.12], z_3 \in [1.75, 2.23]$, and $z_4 \in [4.3, 6.3]$

B. $z_1 \in [-1.3, -0.4]$, $z_2 \in [-0.6, 0.2], z_3 \in [1.75, 2.23]$, and $z_4 \in [4.3, 6.3]$

C. $z_1 \in [-6.8, -4.8]$, $z_2 \in [-2.63, -1.81], z_3 \in [0.33, 0.66]$, and $z_4 \in [0.2, 2]$

D. $z_1 \in [-6.8, -4.8]$, $z_2 \in [-2.63, -1.81], z_3 \in [0.58, 1.18]$, and $z_4 \in [4.3, 6.3]$

E. $z_1 \in [-6.8, -4.8]$, $z_2 \in [-2.63, -1.81], z_3 \in [1.07, 1.78]$, and $z_4 \in [1.4, 3.4]$

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8. What are the *possible Rational* roots of the polynomial below?

$$f(x) = 2x^2 + 4x + 4$$

A. All combinations of: $\dfrac{\pm 1, \pm 2, \pm 4}{\pm 1, \pm 2}$

B. All combinations of: $\dfrac{\pm 1, \pm 2}{\pm 1, \pm 2, \pm 4}$

C. $\pm 1, \pm 2$

D. $\pm 1, \pm 2, \pm 4$

E. There is no formula or theorem that tells us all possible Rational roots.

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9. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{12x^3 + 17x^2 - 24x - 18}{x + 2}$$

A. $a \in [8, 16], \ b \in [-8, -5], \ c \in [-11, -5], \text{ and } r \in [-2, 10].$

B. $a \in [8, 16], \ b \in [38, 42], \ c \in [56, 61], \text{ and } r \in [96, 102].$

C. $a \in [-26, -19], \ b \in [61, 70], \ c \in [-160, -152], \text{ and } r \in [288, 293].$

D. $a \in [8, 16], \ b \in [-22, -17], \ c \in [29, 34], \text{ and } r \in [-121, -116].$

E. $a \in [-26, -19], \ b \in [-35, -28], \ c \in [-87, -83], \text{ and } r \in [-192, -189].$

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10. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{6x^3 + 35x^2 - 127}{x + 5}$$

A. $a \in [6, 10], b \in [4, 6], c \in [-32, -21], \text{ and } r \in [-2, -1].$

B. $a \in [6, 10], b \in [65, 67], c \in [316, 329], \text{ and } r \in [1496, 1502].$

C. $a \in [6, 10], b \in [-5, 1], c \in [5, 9], \text{ and } r \in [-163, -160].$

D. $a \in [-30, -28], b \in [183, 190], c \in [-926, -922], \text{ and } r \in [4497, 4503].$

E. $a \in [-30, -28], b \in [-117, -107], c \in [-578, -574], \text{ and } r \in [-3002, -3001].$
